

SCIENCE

[Entered at the Post-Office of New York, N. Y., as Second-Class Matter.]

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

EIGHTH YEAR.
VOL. XVI. No. 388.

NEW YORK, JULY 11, 1890.

SINGLE COPIES, TEN CENTS.
\$3.50 PER YEAR, IN ADVANCE.

TORNADO LOSSES AND INSURANCE.

THE destruction of life and property by a tornado must ever be regarded as the most important fact from a practical standpoint, and in many respects this feature of the subject is involved in greater confusion and uncertainty than any other. As has already been said, such a violent storm ought to be exceedingly well defined, and the amount of loss determined within a small fraction. One reason for this uncertainty has been the lack of persons desirous of obtaining a complete list of property loss and damage by tornadoes. We have an excellent illustration of an opposite state of affairs in the estimates of loss of property by fire. Here there are hundreds interested in obtaining the exact loss; and it is believed that in this country the loss by fire, whether of insured or uninsured property, is known within four per cent of the actual loss. A most serious difficulty in making such estimates has arisen from a vague and indefinite idea of what a tornado is, and how it should be described. We are told, for example, "if we care for the name 'tornado' to define a distinct class of local storms, then the funnel-shaped cloud, as shown by a distinct rotary movement of the wind, or by peculiar destruction of property, should be made the condition of classification. Both for the purpose of study and practical results, this manner of distinguishing the tornado is desirable. It leaves no doubt as to where the line should be drawn, and recognizes a peculiar and important class of meteorological phenomena, independent of their effect upon life and property, which it is quite well known that they can destroy if given an opportunity." We must take most serious exception to these views. It is manifestly only by the effects displayed by these storms at the earth that we can classify or discuss them. The most violent commotions, the most surprising shapes and appearances of clouds meeting or rolling over each other, might have a passing interest, but surely they would be practically of no account if they did not reach the earth and there affect life and property.

Descriptions.

We have already seen that in the earlier history of these outbursts they became familiarly known by a definite name. For example: the New Brunswick (New Jersey), the New Haven (Connecticut), the Stow (Ohio), tornadoes are definite phenomena and extremely localized. In later times the most terrible tornado but one that has occurred in this country was that at Grinnell, Io. To call this the Poweshiek County tornado, and to say that it had a path 450 to 600 feet wide, takes from it almost entirely its definiteness and extreme destruction. In another instance a tornado is de-

scribed as causing a loss of \$4,000,000,—the greatest in this country, and, for that matter, in the world. This tornado is given a path 2,640 feet wide, and passing through Rock, Hennepin, Ramsay, and Washington Counties, Minn., and through St. Croix, Polk, Barron, Chippewa, and Price Counties, Wis. It is not intended, of course, to convey the idea that there was a clean sweep a half-mile wide through these nine counties; but, to one familiar with the more terrible storms, such a description would convey an idea of a most appalling disaster. A most careful study of this nine-counties tornado has revealed the most astounding result, that there were only two towns injured. The principal loss was at Clear Lake, Wis., \$139,100; and the other town was Marine, Minn., with a loss of about \$65,000. The total direct loss by this tornado in all the counties was not over \$250,000, or one-sixteenth the published loss. It should be insisted on, by all means, that every tornado should have a definite local application and a name. In some cases where the country is thinly populated, and houses are destroyed here and there through many townships, it will be necessary to group all such hamlets in the name of a county or of the principal town visited, but this should be rarely resorted to.

Indirect Loss.

Much confusion has arisen from grouping together losses by the tornado proper, and by floods and hail which accompanied it; also by considering losses to orchards, crops, fences, stock, etc., in connection with that to houses and buildings. Certainly, in calculating risks for tornado insurance, and in studying the definite losses, we should catalogue only the definite and direct loss to structures. It is not a little remarkable, that, while the descriptions of tornadoes have tended to vagueness and indefiniteness as to extent of path and destructiveness, no such difficulty has been encountered in photographing the effects of a tornado. The most completely destroyed houses and blocks, and scenes exhibiting the severest violence of the storm, have always attracted the photographer. This country has had over two thousand tornadoes since 1873, but we would be very much deceived if we thought that the scenes of desolation depicted in half a hundred photographs were experienced at more than two per cent of these. The worst of these photographs are taken from only two or three tornadoes.

Tornado Lists.

These are being published from time to time, and in the main are very untrustworthy, from a lack of care in collation, and a desire to exhibit some preconceived idea as regards the tornado. A careful sifting of the lists has shown that many of these tornadoes were of very slight account,

and many also were straight blows with little violence. Often a whirling cloud does not reach the earth, but it is called a tornado. In one list the Wallingford (Connecticut) tornado of Aug. 9, 1878, is put down as only a heavy thunder-storm, although it ranks among the severest of all, for there were thirty killed, fifty houses destroyed, and \$250,000 of damage done. There will be given later a list of forty-eight of the most severe tornadoes since 1873. No pains have been spared in making this list as complete as possible; and while in a few cases the loss may be slightly overestimated, yet in the main it is believed to be accurate.

Hinrichs's Views.

Mr. Hinrichs of Iowa has devoted many years to the study of tornadoes, and has given careful attention to the subject of a classification. A *résumé* of his views has been given in the *American Meteorological Journal* (vol. v. pp. 306, 341, and 385). He would make a careful distinction between a tornado and a squall, or *derecho*, as he would call it. The latter he describes as a straight-line heavy wind, usually advancing from the north-west for many miles across the State. While it is frequently destructive, yet it is of an entirely different type from the tornado. It is barely possible that there has been a slight confusion here, and that the apparent movement of the *derecho* from north-west to south-east is complicated by the occurrence of a series of tornadoes or destructive thunder-storms running in parallel lines from south-west to north-east. It hardly seems probable that we have to deal with a particular class of storm (*derecho*) in Iowa that is not found east of the Mississippi. What Mr. Hinrichs calls the "front" of the *derecho* may be either a thunder-storm or a tornado, and the universal law controlling these is a movement from south-west to north-east. We have already seen that these violent storms travel in parallel lines, beginning earlier in the afternoon at a point toward the north-west of a tornado region, and gradually working south-east. Each line occurs later and later, and it is also a fact that frequently the later storms have the longer paths. These appearances might also occur in a *derecho*.

Hinrichs's Classification.

The following shows the classification of tornadoes according to Hinrichs's method:—

- A. Notable Tornadoes.
 - Class I. Multiple.
 - (a) Large.
 - (b) Small.
 - Class II. Single.
 - (a) Large.
 - (b) Small.
- B. Minor and Doubtful Tornadoes.

Finley's Classification.

Lieut. Finley would make no effort at a definite classification according to violence or extent, but would take every funnel-shaped cloud, whether it reaches the earth or is seen in the clouds, and give it a county, date, time of occurrence, direction of motion, shape of cloud, and width of path.

Objections.

Neither of these methods seems satisfactory for our purpose. The first is quite involved, and, moreover, unites two

tornadoes under the same head, though they may be twenty miles apart, provided they occurred on the same date. The motion of a tornado is complex: it oftentimes lifts, and passes a dozen miles before again striking the earth. Again, we have several occurring in parallel paths on the same date. To unite these together under the head of a "multiple tornado" seems very injudicious. It will serve to great definiteness if we consider each descent of a tornado-cloud, and each occurrence of destruction in parallel bands, as a separate tornado. My meaning should be distinctly understood. I would call the tornado of St. Cloud and Sauk Rapids, Minn., a single occurrence, because the cloud did not lift between these two; also the Louisville and Jeffersonville tornado was a single occurrence, for the same reason. I would call the Fayetteville (Arkansas) and Marshfield (Missouri) tornadoes separate occurrences, though having the same date, April 18, 1880. They were a great many miles apart, and, while undoubtedly in the same tornado region, yet they should be kept distinct.

Scale of Violence.

The establishment of a scale of violence is one of the most important steps to be taken at this stage of our studies and information. The question arises at once as to whether this scale should be according to the violence displayed in twisting trees and destroying houses, or according to the property loss. The former would be a very difficult matter to determine, but should certainly be coupled with the extent of region over which the manifestation occurred. It is also true that we should have with every tornado and destructive storm a definite estimate made, as impartially as possible, of the property loss. We may hope ere long that a beginning of interest will occur and develop in this direction, as has already appeared in the study of fire losses. By what precedes, it is plain that our ultimate arrangement of tornadoes according to a scale would place the more violent in a slightly different position from the more destructive; but this difference is exceedingly slight, and, until we make finer distinctions than are possible now, we can easily place the most violent and destructive in a class by themselves, or on a scale of 3 in class (3). Going to the other end of the scale, we will put the least violent at (1), and (2) will comprise all between these two. Of course, no hard and fast line can be drawn between these different grades, and some would put a few on the border of (2), in (3), and *vice versa*, but this is a very small matter. It is very important that in our lists the dates be arranged chronologically; but, if we wish to make a distinction between tornadoes at the border-lines, we may do so by using the plus and minus signs: for example, (3—) would be near to (2+), and (3+) would be the highest in the scale. This would be a step toward dividing into nine classes instead of three. Another method of classification would be to determine the number of houses destroyed in each tornado, and then arrange the list on this basis. Such a list would not differ materially from the former. The only difficulty would be in assigning the proper number of houses under each scale. For purposes of comparison and in computing risks, we might also arrange a list of towns destroyed, or partly destroyed, according to an arbitrary scale. It matters little what method we adopt, for it is probable that any scheme

would give practically the same final comparison, but it is absolutely essential that we adopt some scale.

Authorities.

The most complete general description of tornadoes is to be found in the *Monthly Weather Review*, published by the Signal Service. In addition, we have descriptions of violent storms in our newspapers, and publications by Lieut. Finley. The most complete list of tornadoes has just been finished by Lieut. Finley in the *American Meteorological Journal*. This contains only the date, time of day, width and direction of path, and gives us no idea whatever of the destruction, which is by far the most important characteristic, and the only one that concerns us here. It has been found impossible to use this list, and the original authorities have been studied in making out a final description of tornadoes for this discussion. The method adopted for this list was to form as clear an idea as possible of the amount of violence and loss that should be given to each division of the scale, and then to put each tornado and violent storm rigidly in its proper place. If any doubt occurred as to whether the storm came, for example, in (3) or (2), it was indicated by a minus or plus sign, as just described. It was found necessary to begin the list with 1873, and it ends with 1888. The total number of tornadoes during these sixteen years was 2,221; or, by scale, 48 (3), 988 (2), and 1,185 (1). In the

Résumé of Tornadoes, 1873-88.

	NUMBER.					LOSS.			
	(3)	(2)	(1)	Total.	Total by Weight.	(3)	(2)	(1)	Total.
Alabama.....	3	55	20	78	139	\$380,000	\$1,100,000	\$60,000	\$1,540,000
Arkansas.....	4	35	24	63	106	430,000	700,000	72,000	1,202,000
Georgia.....		77	53	130	207		1,540,000	159,000	1,699,000
Illinois.....	6	102	129	237	351	1,250,000	2,040,000	387,000	3,677,000
Indiana.....	2	56	58	116	176	275,000	1,120,000	174,000	1,569,000
Iowa.....	3	61	75	139	206	740,000	1,220,000	225,000	2,185,000
Kansas.....	3	103	109	215	324	350,000	2,060,000	327,000	2,737,000
Michigan.....		31	48	79	110		620,000	144,300	764,000
Minnesota.....	3	29	45	77	112	1,000,000	580,000	135,000	1,715,000
Mississippi....	4	25	18	47	80	620,000	500,000	54,000	1,174,000
Missouri.....	7	76	60	143	233	1,185,000	1,520,000	180,000	2,885,000
New York....	1	49	70	120	171	80,000	930,000	210,000	1,270,000
North Carolina		32	30	62	94		640,000	90,000	730,000
Ohio.....	4	84	87	175	267	1,030,000	1,680,000	261,000	2,971,000
Pennsylvania..		45	66	111	156		900,000	193,000	1,098,000
South Carolina	1	29	20	50	81	200,000	580,000	60,000	840,000
Wisconsin.....	3	53	48	104	163	650,000	1,060,000	144,000	1,854,000
Total.....	44	942	960	1,946	2,976	8,190,000	18,840,000	2,880,000	29,910,000
All States....	48	988	1,185	2,221	3,305	9,650,000	19,760,000	3,555,000	32,965,000

accompanying table are grouped these tornadoes in the seventeen States in which they are the most frequent. A careful study of this table will reveal most interesting and unexpected results. That Ohio, New York, and Pennsylvania

should stand so high in this list is largely due to the fact that tornadoes have been so thoroughly reported in those States. A severe storm in any one of these States is noticed far more than in States where local storms are more abundant. An attempt has been made to determine the total tornado loss in these States. Outside of the forty-eight most destructive, scale (3), it is impossible to get an accurate estimate of the average loss. In two instances where the newspapers had reported great loss by a funnel-cloud, a careful examination revealed the fact that such a funnel-cloud had reached the earth; but the total damage in one case was \$200, and in the other \$75. Whatever may be the estimated loss, we have here the figures giving the number of tornadoes, and we can easily determine the true loss if at any time we find the average loss. After a careful study of the reports, it has been decided to place the average loss by tornadoes, scale (2), as \$20,000 each, and by (1) as \$3,000 each. There is no doubt at all that this estimate is at least ten per cent too great. The figures in the last column of this table give the total loss in each State. Taking the total number of tornadoes from 1873 to 1888, or 2,221, and dividing the total loss, \$32,965,000, by it, we obtain \$14,842 as the average loss by each tornado.

These figures are very significant, and will bear the closest scrutiny. We may make an interesting comparison with the only other list that is at all complete. This contains 2,435 tornadoes as having occurred in this country with a total loss of \$941,282,500, or a loss by each tornado of \$386,564. Taking the forty-eight tornadoes in the above list, scale (3), we find the total loss, as carefully determined, \$9,650,000, or a loss of \$201,042 for each; that is to say, if the former estimate has any value at all, this country has been visited by 2,435 tornadoes, each of which was nearly twice as destructive as each one of the forty-eight tornadoes known to be most destructive. It is safe to say, that, were our Western States subject to such appalling disaster as this, they would have been depopulated long ago. We have just seen that from 1873 to 1888 the average loss by the 2,221 tornadoes was \$14,842, with a margin of at least ten per cent too great an estimate; or, in other words, the actual loss from tornadoes in this country is one twenty-sixth, or only four per cent, of that estimated in the list above.

It will be distinctly understood that there is no desire in all this to make out that there is no danger from tornadoes, or to minimize their effects. It is of the utmost importance that the true facts be established; that the people understand that entirely unnecessary fears have been aroused; and that the extremest exaggeration has occurred from, it is to be feared, an unfortunate desire to influence their actions in regard to tornadoes. The worst is bad enough without exaggeration. Fears have also been engendered from an extreme agitation of this subject in the line of protecting lives from these outbursts. The protection of life is the most important of all, but there is no necessity of going to the expense of having a so-called tornado-cave constructed, and, above all, of spending hours in such a cave, as we have frequent reports of persons doing because of terror inspired by improper reports. It is probable that no tornado ever visited a place without giving ample warning by the great roar (in some cases reported as thirty minutes, and even more, before the outburst) or by the unmistakable funnel-cloud. A cellar under the

house is an ample protection, and none other is really needed. Above all, the people of the West should allay their fears at the appearance of every threatening or lurid cloud in the south-west horizon.

Warnings.

As the Western States become more thickly populated, it is probable that some means will be resorted to, to warn the villages of the approach of a veritable tornado. Outposts placed at a mile or two to the south-west or west would have an excellent opportunity to watch for such outbursts, and give the signal for the inhabitants to watch for the cloud. It would be a great advantage to all concerned if people could realize that the tornado proper is an exceedingly definite and unmistakable phenomenon; that it does not come upon a house like a stroke of lightning, unseen and unheralded. Instances are by no means rare where the funnel has been seen advancing directly over a person, and has been easily avoided by running to the north or north-west. On the south side of the path there are indraughts extending to quite a distance; so that it is generally safer, unless the track of the tornado is seen to be quite to the north of the observer, for one to run to the north-west, but never to the north-east or east, as that is in the line of the tornado. Persons have stood within one hundred and fifty feet of the tornado on the north side, and have felt no unusual disturbance. *It is admitted, however, that this requires no unusual courage. Let the people of the West look upon this phenomenon more in the light of its great peculiarity and wonderful nature,—a nature which has absolutely no parallel, and one the study of which must be for years to come of the highest importance. The wisest philosopher has hardly begun to get an inkling of its formation; and those who are so minded can, by a careful observation and record, help in obtaining and formulating the facts regarding this extraordinary appearance.

Can the Tornado Energy be Dissipated?

The time is coming when this question will become exceedingly important. It is very unsafe to theorize without some facts to start from. It is probable that often serious damage will be warded off from a town which has an extensive forest to the south-west and west. If the energy of a tornado is in an electrical action, as it most undoubtedly is, there is no reason why this may not be diminished by a properly arranged network of wires and poles to the south-west. A tornado is exactly the same as a water-spout at sea; and, if ships have broken up such a spout from the concussion produced by the firing of a cannon, there seems no reason why the energy of a tornado may not be largely diminished by the explosion of gunpowder or dynamite. Of course, the great difficulty would be to make the explosion anywhere near the tornado. Further than this, we cannot go without experiments, and, above all, without a better knowledge of the force producing the energy manifested.

Insurance.

Next to the loss of life and destruction of property by a tornado comes the practical question, "Can I and shall I insure my property against this loss?" Undoubtedly both the public and insurance companies have been misled on this subject, and yet it will be distinctly understood that in

whatever is written here there is no censure implied. I have been in correspondence with these companies, and find that they have been groping in the dark; but they are watching tornado risks very carefully, and are prepared to make a change when such is deemed advisable. It is a remarkable fact, that, out of the thousands who have insured their property against tornadoes during the past six years, only two, so far as published, have received any return, and these for \$2,000 each. If we should examine the returns for fire insurance, no such state of affairs as this would be found, and the reason for it is not far to seek. Usually tornado insurance is placed in the towns where a tornado has just occurred, and, like lightning, the path of a tornado never runs twice in the same line. When we consider the extremely narrow path of a tornado, this is not to be wondered at. After the recent tornado in Louisville, Ky., we are told that tornado insurance had a most extraordinary boom, and it was being placed at a rate even greater than that for fire insurance in some cases. This is most extraordinary, and can only be explained on the supposition that all classes had had their attention called to incorrect views, and were not cognizant of, or had not studied, the true relations of the subject. We have already seen that in the nine-counties tornado the actual losses of \$250,000 were exaggerated to \$4,000,000; but what shall be said when we learn that after the returns from all tornadoes were in, and we must consider that these returns represented far more than the actual loss, it was decided to multiply them by 25, that is, increase the losses by 2,500 per cent, on the plea that all the losses were not reported. It is not to be wondered at that under such manipulations every one has been very much mystified. As to the Louisville tornado, we shall find that Kentucky is not classed as a tornado State even. It is doubtful if another such tornado ever strikes Kentucky, certainly not in a hundred years.

Risk.

This whole matter of insurance depends on the risk. If a company should be organized to insure a house against being knocked down by a meteor, no one would dream of such a thing as noticing it, except in pity. No company was ever organized to place insurance against lightning distinctively; but the risk is so slight, that all or nearly all companies simply add that risk to the regular fire risk. I think it can be shown that the tornado risk is not so vastly different from that of lightning. Suppose a man's life is insured, and he wants to go into a tornado region: not one word is said by the company. But suppose the man goes South during the summer season: he must take his own risk, for the company will not take it. The difference in these cases is very plain: the chance of death in the first instance is perhaps one in a million or less, while in the second it may be one in a thousand or more. These illustrations will suffice to make this subject clear to those who have given no thought to it. If we can find the relative risk between lightning and tornadoes or between fire and the same, or if we can find the chance that any given house will be struck, we shall have a basis upon which to reckon the importance of this insurance. It is an eminently practical question to be solved by the law of chances, and not an undetermined factor, or a subject to be accounted for on the plea that it is the

working of an inscrutable providence; and we must be resigned to our fate if we do not insure against it. The fire hazard has been very accurately computed, and it is known approximately just how many persons will insure their property, and how high it is necessary to put the premium in order to pay the losses and expenses. Whenever a tremendous conflagration like that of Chicago or Boston breaks forth, these estimates are entirely wrong, and many companies are forced to the wall. It is impossible, however, to allow for such calamities; and it is probable, that, excepting some minor changes, no radical change in fire insurance has occurred on account of those fires.

Tornado Risk.

If we knew, approximately even, just the loss from tornadoes, and could place the insurance where the loss of houses blown down and the expense of insurance would not be greater than the gain in premiums, we would have an ideal state of insurance, and we could tell just the amount each householder should pay. Or if we knew just the average loss per year in the tornado States, and could persuade enough people to take up this kind of insurance, it is plain the business could be carried on profitably. One difficulty now encountered is, that people do not ordinarily see that the risk is any thing like that represented (which is true), and consequently only a small fraction of this kind of insurance is taken as compared with fire insurance. It would take a great many years to determine tornado risks with sufficient accuracy to estimate the amount of premium needed; but we can make a comparison with the risks and losses by fire, and thus arrive at an approximate solution of the question. It should be noted, however, that these risks are of very different characters. The fire risk is ever present and a perpetual menace. Moreover, it is one which is in great danger of propagating itself, or becoming enormously great by communication from house to house. A tornado is more like an accident: it happens at the rarest intervals, and there is no spreading. We might compare these risks as those coming to a man's life in going to a fever district and in going to a tornado district respectively, as was done above. It may be objected that we cannot compare fire insurance with that for tornadoes, in that fire losses are much greater in large cities, where the population is denser than in the country. The objection is not a serious one, for the reason that the greatest destruction from tornadoes has been in our large cities; and, again, the protection against fire is much more perfect in the city than in the country; in fact, insurance premiums are less in the city than in the country on a great many kinds of property.

[Continued on p. 22.]

NOTES AND NEWS.

THE *Open Court* of Chicago has republished in a volume entitled "Wheelbarrow" a series of articles and discussions on the labor question that have been appearing in its columns for some time past. The anonymous author of the work tells us in his introductory chapter that he was for a considerable part of his life a manual laborer, though he has since risen to higher positions. Hence he speaks of the workingman's life from actual experience, and so far is qualified for the work he has here undertaken. But unfortunately he has not taken the trouble to study the scientific aspect of the subjects he deals with, and even confesses his mental

incapacity to do so. He has, however, many sound and sensible ideas, though none of them are new. He is opposed to all forms of communism and anarchism, and equally so to Henry Georgeism, and animadverts severely on the monopolistic spirit of the trades unions. But he writes in a coarse style, and often in a tone of arrogance and of bitterness towards capitalists that repels the reader. On the whole, we cannot see that he has contributed any thing to the solution of the labor problem.

—It is a well-known fact in biology that bacteria and bacilli absorb aniline and are killed by it. Two German observers—Stilling and Wortmann—have recently considered the possibility of utilizing this property in medical treatment (Humboldt). The diffusibility and harmlessness of violet aniline dyes (called, for brevity, "methyl-violet") without arsenic, in small doses, were first demonstrated on rabbits and guinea-pigs, as we learn from *Nature* of June 26. Then certain eye-disorders were produced in those animals, and treated with aniline solution, the results being excellent. The authors proceeded to operate on the human subject. A skin ulcer on a scrofulous child, which had been treated for a month with the ordinary antiseptic agents without success, was gradually healed by daily dropping a little aniline solution on the sore, and similar good results were had with bad cases of eye-disease. It soon appeared that many surgical cases were open to successful treatment in this way, and that, in general, wounds and sores developing suppuration could be sterilized with aniline. It is also thought that cases of internal inflammation, as in pleuritis and peritonitis, may prove to be not beyond the reach of this order of treatment.

—The commission appointed to consider the question of coal-waste in the State of Pennsylvania,—J. A. Price, E. B. Coxe, and P. W. Sheaffer,—who may be addressed at Scranton, Penn., are desirous of making the investigation as comprehensive and as exhaustive as possible. It is of course absolutely necessary to obtain the results of all the best practical experience upon the subject, so as to, as far as possible, diminish in the future the waste, and to encourage the utilization of what are now waste products. This commission would be very glad to have a full expression of views upon any of the following divisions of the subject which they have adopted for the study of this most important problem. The divisions are as follows: geological and statistical waste, including estimate of the original geological coal-field and waste of erosion, estimate of existing coal-field before coal-mining began, estimate of amount worked to the present year, and estimate of the total amount that it is possible to take from the earth by any known system of mining (giving the amount that must be left in the ground in shape of pillars, etc., or what may be regarded as permanent structural waste); waste of producing and marketing, including investigation of the underground waste of mining, investigation of the waste of preparation (including all processes in which the commercial size has been continually reduced, the amount of culm in sight at place of preparation, and the annual product of culm), and investigation of the marketing of the pea, buckwheat, bird's-eye or rice, and dust, and the uses to which the several sizes or conditions are put; utilization of coal-waste, including examination of the whole briquette system, duly recorded tests under responsible supervision, patent office records, specimen forms, and chemical analyses, accumulation of the record of all the practical mechanical appliances by which the waste is utilized without mechanical preparation (such as devices of furnaces, grates, blowers, etc.), investigation of the use of waste after mechanical preparation for combustion (as in pulverized conditions, etc.), and examination of the gasifying processes into water-gas and producer-gas, also in the destruction of garbage or cremating work, also in agricultural experimentation.

—According to a newspaper bulletin just issued by Dr. C. M. Weed, entomologist of the Ohio Experiment Station, the maple bark-louse has become destructively numerous over a large portion of Ohio, and is creating much alarm by its presence. It is especially at work upon the shade-trees of cities and villages, and unless checked there is every indication that the trees will be seriously injured. The insect has been reported as very abundant

in Cleveland and Canton, and is present in many parts of Columbus. It probably occurs, also, in a large number of other cities and towns of the State. The presence of the pests is shown by the occurrence upon the twigs of maple-trees, especially on the under side, of a brown, circular, leathery scale about one-quarter of an inch in diameter, beneath which is a fluffy, cottony mass, that at this time is alive with hundreds of young lice, appearing to the unaided eye as minute white specks moving about. About six years ago there was a similar outbreak of this insect in Ohio, Illinois, Michigan, and adjacent States, when many trees were rendered unsightly and filthy by the presence of the lice, and some were killed by the attack. This maple bark-louse is an insect belonging to a family of peculiar habits and histories. Under each of the scales there was a month ago from 700 to 1,000 small white eggs. These eggs have since hatched into young lice, which are now scattering over the trees, and will soon fix themselves upon the leaves, where they will remain throughout the season. They insert a tiny beak into the leaf, and suck the sap. In autumn before the foliage drops they desert the leaves, and fasten themselves to the twigs. Much of the sap that is sucked from the foliage passes through the bodies, and falls to the ground. This is frequently called honey-dew. Some of the most intelligent citizens of Columbus report that during the outbreak of 1884 they cleared their shade-trees of the scales and young lice by using a stream of water from the hose, forcing it into the trees, and washing them off. When this simple water treatment is not practicable, the next method would be spraying with what is known as kerosene emulsion. These bark-lice have various natural enemies, which prey upon them. These enemies checked the outbreak quite suddenly in 1885, and probably in a year or two they will reduce their present numbers below the danger line; but in the mean while artificial remedies should be used as much as practicable.

—*Das Wetter* for May contains an article by Dr. P. Perlewitz upon the influence of the town of Berlin upon its climate. He finds, as given in *Nature*, that the difference of the mean temperature between the town and the open country outside differs, in various months, from 0.7° to 2.3° , the town being always warmer. The smallest differences are in spring and winter. The greatest daily differences are found to be in the evening, owing to a retardation of radiation in the town. From this time the difference decreases until about mid-day, when there is no perceptible difference between the two localities. Dr. Hann has found similar results for Vienna; but the differences there are smaller, owing to the better exposure of the town station. The humidity is less in the town than in the country. In the evening, in June and July, the difference amounts to above 19 per cent. No appreciable effect appears to be exerted by the town upon the rainfall, as compared with that of the country stations.

—Mr. Belelubsky, professor at the Institute of Roads and Waterways at St. Petersburg, was some time ago instructed by the minister of public works to make an examination of the suspension bridge over the Dnieper at Kiew, which was erected some forty years ago by the late Mr. Charles B. Vignoles, and to give an opinion as to the quality of the metal used in its construction. Luckily, from a scientific point of view, a number of extra links which had been provided at the time of the erection of the bridge, were still in store, and it was thus possible to determine by comparative tests what changes the material of the links of the bridge had undergone in their forty years of service. The links in question, according to *Engineering* of June 20, were about 11 feet 9 inches long, by $11\frac{1}{2}$ inches broad, by 1 inch thick. Stated briefly, the results of the tests show that the iron has not at all deteriorated during its long service. The mean of four specimens of links taken from the bridge gave an ultimate strength of 20.7 tons per square inch, with an elongation of 14.5 per cent on 8 inches, while an equal number of tests of specimens from unused links gave a breaking stress of 22.2 tons per square inch, with an elongation of 13.4 per cent in 8 inches.

—There is a disease in Japan known as *kakke*, a disorder of the kidneys communicated by bacilli, and closely related to the more virulent *beri-beri*. From the distribution of *kakke*, M. Gueit, as

related in *Nature*, has drawn conclusions as to the ethnic composition of the present population of Japan. The fact that Chinese always escape the disease, even in localities where it is very prevalent, indicates (in his opinion) that the Chinese or Mongolian element is not the dominant one. He finds three constituents in the population: (1) descendants of Ainos; (2) descendants of Negritos; and (3) a Malayan element, which is the most prominent. Wherever the Malayan goes, he brings with him the *beri-beri* order of disease, his liability to this being probably due to the Hindoo blood in him. From India we find *beri-beri* spread, like the Malays, to Madagascar on the one side, and to Japan on the other; we meet with it also in Java, Sumatra, etc. According to the proportion of Malay blood in the natives of Japan is the frequency of the malady, which occurs in various forms and under different names. As to the Negrito element in Japan, M. Gueit found an interesting proof of it in the island of Sikok, in the form of a small statuette of Buddha, having the characteristic nose and hair of the Negritos.

—The long imprisonment of beetles within furniture is treated of in the last report issued by the New York State Museum of Natural History. It is suggested that when such cases occur, the conditions may bring about a lethargic state in which respiration and accompanying phenomena are almost or entirely suspended through the complete exclusion of air by the rubbing, oiling, and varnishing or other polishing the furniture has undergone. This instance of the imprisonment of a beetle is cited, says *The Illustrated American*: "In 1786 a son of Gen. Israel Putnam, residing at Williamstown, Mass., had a table made from one of his apple-trees. Many years afterwards the gnawing of an insect was heard in the leaves of this table, which noise continued for a year or two, when a large, long-horned beetle made its exit therefrom. Subsequently the same noise was heard again, and a second insect, and afterward a third, all of the same kind, issued from this table-leaf; the first one coming out twenty, and the last one twenty-eight, years after the tree was cut down."

—Dr. G. Hellmann, to whom meteorologists are indebted for various interesting investigations into the history of meteorology, has contributed to *Himmel und Erde* (Heft. 3 and 4, 1890) two instructive articles on "The Beginnings of Meteorological Observations and Instruments." He divides the history of the development of observations into three periods: (1) that ending with the middle of the fifteenth century, up to which time they were of a very fragmentary and almost aimless character; (2) that in which observations were taken at least once a day; and (3) that in which they were systematically taken with instruments, dating from about the middle of the seventeenth century. It is not exactly known who first kept a regular meteorological journal; but Humboldt attributes it to Columbus, on his first voyage to America in 1492, while the Italians also appear to have made daily observations from the middle of the fifteenth century. The wind-vane is by far the oldest of the meteorological instruments. In the periods of Homer and Hesiod, in the ninth and eighth centuries B.C., the qualities of the winds were correctly described. The first arrangement for observing the wind-direction is the Temple of Winds at Athens, which was built about 100 years B.C. A picture of this tower is given by Dr. Hellmann. Eginhard, in the reign of Charlemagne, denoted the winds by the four cardinal points, and their variations. The first instrument for denoting the force of the wind is ascribed to Robert Hooke (1667). This instrument is essentially the same as that now used, and known as Wild's pendulum anemometer. The absorption or organic hygrometer was invented about the middle of the fifteenth century, by N. de Cusa, although the invention is generally ascribed to L. da Vinci. The first condensation hygrometer is attributed to the Grand Duke Ferdinand II. of Tuscany. The first continuous hygrometrical observations appear to have been by R. Boyle, at Oxford, in June, 1666. The first thermometer is attributed to G. Galilei, towards the end of the sixteenth century. Some few years later, the instrument was improved, although the freezing-point was the only fixed point determined; and the graduation was made by means of little knobs in the glass, every tenth one being enamelled. The first rain-gauge was used by B.

Castelli in 1639, although usually a later date is quoted. The discovery of the Torricellian tube, in 1643, is too well known to require special remark. These are only a few of the very interesting points referred to in Dr. Hellmann's instructive investigations.

— At the regular monthly meeting of the American Institute of Electrical Engineers, held June 17, 1890, the following resolutions, recommended by the council, were introduced by Mr. Francis B. Crocker, with the request that they be taken up for action at the next meeting of the institute in September: "Whereas it has been the custom in the nomenclature of electrical units to perpetuate the names of men who have contributed most to electrical science; and whereas, in the names thus far adopted, the eminent services of Americans have not been recognized: therefore resolved, that in the opinion of the American Institute of Electrical Engineers, a just distribution of the honors thus bestowed necessitates a recognition of the splendid contributions to electrical science of one or both of America's great electricians, — Benjamin Franklin and Joseph Henry; that this institute will gladly co-operate with other bodies in this country and abroad to secure the general adoption of these names for electrical units; that the name of 'Henry' should be given to the practical unit of self-induction, since he was the discoverer and greatest investigator of this phenomenon, and because this unit at the present time is called a quadrant, which is merely a numerical value, and not a suitable name; and that this institute recommend to electrical societies and electrical engineers the general use of the name 'Henry' for the unit of induction as being the quickest and surest way to secure its final adoption." It is unfortunate that the name of "Henry" for the unit of induction was not adopted at the Paris Electric Congress of 1889. If the attention of the congress had been forcibly called to the fact that Henry discovered self-induction, and that his work on both self and mutual induction was of the greatest importance, his name would probably have been adopted then. Henry's discovery of self-induction, which is, of course, the fact that gives the strongest claim, was made in 1832, and published the same year in *Silliman's Journal*. In that paper he described experiments showing that the spark obtained by breaking a circuit composed of battery and a long wire is greater than with a short wire, and that the spark is further increased by coiling the wire. He then clearly states that the phenomenon is due to the action of the current on itself, all of which is perfectly correct, and would be a good statement of the facts even at the present time.

— The thirty-ninth meeting of the American Association for the Advancement of Science will be held at Indianapolis, Ind., beginning on Tuesday, Aug. 19, 1890, at noon, by a meeting of the council at the Denison House, where will be the hotel headquarters of the association. By special favor of the State authorities the general sessions and the meetings of the sections will all be held in the new and commodious State House, where also will be the offices of the local committee and of the permanent secretary. This meeting will be the fiftieth anniversary of the organization of the Association of Geologists and Naturalists, the parent of the American Association, which will add to the interest of the meeting. The arrangements made by the local committee for the comfortable entertainment of the large number of members and their friends expected to be present, and the unusual accommodations offered, by which all the sections will meet in large halls under one roof, will probably make this the most important meeting ever held in the West. Indianapolis is as comfortable in August as any city away from the seacoast. Its streets are wide and well shaded, and its hotels are large and comfortable: so members need not be deterred from going there by the fear of extra heat and discomfort. On Wednesday, Aug. 20, the first general session of the meeting will begin at ten o'clock in the forenoon in the House of Representatives. After the adjournment of the general session, the several sections will organize in their respective rooms. In the afternoon the vice-presidents will give their addresses before their respective sections; and in the evening there will be a general session, when the retiring president, Professor T. C. Mendenhall, will deliver his address. The

sessions will continue until the Tuesday evening following; and on Wednesday morning, Aug. 27, a meeting of the council will be held. Saturday, Aug. 23, will be given to excursions. The meeting will close with excursions extending to Aug. 30. A special circular in relation to railroads, hotels, excursions, and other matters, will be issued by the local committee; and members who are about changing their address for the summer should notify the local secretary at once, and he should be addressed upon all matters relating to local arrangements and in relation to transportation. For all matters pertaining to membership, papers, and business of the association, address the permanent secretary at Salem, Mass., up to Aug. 15. From Aug. 15 until Aug. 30, his address will be The Denison House, Indianapolis, Ind.

— The death-rate in England in 1889, according to *Medical News* of July 5, was 17.9 per 1,000; in 1888, 17.8 per 1,000. For each of the nine years 1881–89 the rate was lower than in any year prior to 1881, and the average annual rate for that period was only 18.9 per 1,000. For the ten years 1871–80, the average annual rate was 21.4 per 1,000. This shows a saving of 2.5 in every 1,000 of the population, comparing the last two decades with each other. The registrar-general of England estimates that not less than 600,000 people in England and Wales at present survive by reason of the declining mortality rate; that is, if the rate 21.4 per 1,000 had persisted in the past nine years instead of falling to 13.9, there would have been 600,000 more deaths. This improvement is no doubt largely referrible to the improved sanitary condition of the United Kingdom, more especially in the great cities. One proof of this is seen in the decreasing mortality from zymotic diseases, such as small pox, scarlet-fever, and typhoid-fever. Infant mortality, also, has shown a marked decline, and is another index of the life-saving results of an improved sanitation.

— Miss Fawcett's triumph in the mathematical tripos puts the crown on a long series of successes by lady students at Cambridge. There have now been lady "seniors" in all the important triposes (except law). Here is the list: — Moral science tripos: in 1880 Miss Jones was bracketed senior, in 1881 Miss Moberly was senior, and so in 1884 was Miss Hughes. Historical tripos: in 1886 Miss Rolleston (daughter of the late Oxford professor of zoölogy) was bracketed senior, and in 1887 Miss Blanche Paul was similarly placed. Mediæval and modern languages tripos: here there have been four lady seniors. In 1886 two ladies and no men were placed in the first class. The ladies, who were placed in alphabetical order, were Miss Chamberlain and Miss Skeat (daughter of Professor Skeat). In 1887 Miss Harvey was senior; and in 1888, Miss Tuke (whose father is well known in connection with schemes of Irish emigration). Finally, there are the successes of Miss Ramsay in the classical tripos (1887), and of Miss Fawcett in the mathematical (1890). Of these eleven lady seniors, two came from Girton (Miss Jones and Miss Ramsay), the rest from Newnham. It is often asked what becomes of lady students when they leave college. A few particulars about some of these lady seniors may therefore be added. Miss Ramsay is now Mrs. Montague Butler, the wife of the master of Trinity; Miss Moberly is head mistress of the Tunbridge Wells High School for Girls; Miss Hughes is head of a training-college at Cambridge; Miss Chamberlain is instructor in German at Bryn Mawr College, Philadelphia; and Miss Jones is moral-science lecturer at Girton. Promptly to repair the apparent neglect of legal studies came the news of the success of women law-students at Paris, where Mlle. Belcesco, a Roumanian girl, has just taken her degree as *docteur en droit* after obtaining the highest place in the licentiates' examination. A French lady and two of Russian birth also did well. The London *Daily News* tells us one or two interesting facts about Mlle. Belcesco,—that she means to practise at the bar at Bucharest, confining herself to the cases of poor women who cannot pay counsel; and that her thesis for admission to the Paris faculty contained seven hundred pages, of which two hundred were, with an exercise of prudence on the part of the lady, not read. The fact that not Portia herself would be allowed to practise in England no doubt explains why women have not yet carried off the honors of the law tripos at Cambridge.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY

N. D. C. HODGES,

47 LAFAYETTE-PLACE, NEW YORK.

SUBSCRIPTIONS.—United States and Canada..... \$3.50 a year.

Great Britain and Europe..... 4.50 a year.

Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XVI. NEW YORK, JULY 11, 1890. No. 388.

CONTENTS:

TORNADO LOSSES AND INSURANCE	BOOK-REVIEWS.	
H. A. Hazen 15	Advanced Physiography.....	25
	Graphical Statics	25
NOTES AND NEWS..... 19	Cycling Art, Energy and Locomotion.....	25
M. PASTEUR AND HYDROPHOBIA	Steam	26
Thomas M. Dolan 23	AMONG THE PUBLISHERS.....	26

TORNADO LOSSES AND INSURANCE.

[Continued from p. 19.]

Constancy of Tornadoes.

It is an exceedingly important question to determine, if possible, whether tornadoes are on the increase, or whether we may reason from their occurrence in the past as to their probable action in the future. The tendency is to take serious alarm when a tornado has happened near a community, and to conclude at once that the risk has suddenly become very much greater than before, and is likely to continue. We may cite as an instance the alarm in a good many minds after the occurrence of the recent Louisville tornado. Notwithstanding the fact that this was the first serious tornado in Kentucky, and that in all probability another such would never occur there, certainly not in Louisville, yet many seem to have thought that a change had come in the climate, and we were now to have more of these outbursts. A careful study has shown that such fears are groundless, and that our climate is practically constant. We may strike an average of tornadoes in the past, and reason that there will be no more than that average in the future. In fact, if we include 1883 and 1884 in our average, we know that it will be too great, for a very large number

of tornadoes occurred in those years. It is to be noted that the reports of tornadoes must necessarily increase as houses increase in the tornado States, but this will be balanced by the fact that fire losses will also increase. It is perfectly safe for us to compare fire and tornado losses, and to determine approximately what the comparative premium should be.

The accompanying table shows for the years 1876-84, in the seventeen tornado States, the total loss by tornadoes of scale (3), (2), (1); the loss by fire during the same years; and the relative loss by the two.

Tornado and Fire Losses in Seventeen States, 1876-84.

	NUMBER.			LOSS.		
	(3)	(2)	(1)	Tornado.	Fire.	Tornado Fire.
Alabama	1	30	8	\$704,000	\$6,169,000	1-9
Arkansas	3	21	18	754,000	6,419,000	1-9
Georgia		54	32	1,176,000	14,083,000	1-12
Illinois	4	77	87	2,601,000	38,080,000	1-15
Indiana	1	42	30	1,005,000	22,981,000	1-23
Iowa.....	3	42	50	1,730,000	14,821,000	1-9
Kansas.....	2	77	68	1,944,000	6,108,000	1-3
Michigan.....		24	18	534,000	30,583,000	1-57
Minnesota.....	2	20	23	1,069,000	18,752,000	1-18
Mississippi.....	4	21	15	1,085,000	5,479,000	1-5
Missouri.....	7	61	45	3,250,000	27,129,000	1-12
New York.....	1	34	33	859,000	124,767,000	1-145
North Carolina		18	11	393,000	6,486,000	1-17
Ohio.....	2	42	35	1,225,000	41,496,000	1-34
Pennsylvania		22	22	506,000	69,869,000	1-138
South Carolina.....	1	24	12	716,000	7,747,000	1-11
Wisconsin.....	3	39	33	1,529,000	21,375,000	1-14
Total	34	648	540	20,080,000	462,324,000	1-23
Total, omitting Pennsylvania & New York	33	592	485	18,715,000	267,688,000	1-14

The tornado loss in this table has been rigidly computed from the actual estimated loss for scale (3), and allowing \$20,000 each for (2), and \$3,000 each for (1). There is no doubt that this loss is more than ten per cent too great. It should also be remembered that during the two years 1883 and 1884 there were as many tornadoes as in the remaining seven, and in the sixteen years thus far studied this is very nearly the relation. There are several most astonishing facts brought out in this table, and such as are very difficult to understand. Perhaps the most surprising result is that in Kansas the tornado loss is one-third of that by fire. I have gone over the data, and can find no flaw. All the tornado reports from the different States were treated exactly alike, and the result for any one State may be compared directly with that for any other. In Nebraska, a neighboring State, the tornado loss is insignificant, not more than one-twentieth of that by fire; and in Missouri it is one-twelfth of the fire loss. Of course, where no estimate of the loss is given, as is the case in more than half the occurrences, the position in the scale is dependent on the reported violence of the tornado. I am inclined to think that Kansas has had

its severe storms multiplied by reporters to too great an extent. It seems necessary to give these figures exactly as they came out; and I shall be very much gratified if the citizens or professional men of any State, feeling that their State has not been given a fair show, should make for themselves a careful canvass of the State for tornado losses. I shall be pleased to send to any such State a list of the dates of all the tornadoes reported from that State, for the authorities or those interested to verify the losses sustained. I have attempted, by correspondence and in other ways, to get more complete returns, but there seems to be great apathy on this question. Possibly many have been very much discouraged at the palpable exaggerations that have been published. It seems to me that this matter is of the greatest importance, and now is the time to establish an accurate estimate of tornado losses which will be of permanent value for comparison with future years. Certainly more harm will come from vague reports of doubtful tornadoes and exaggerated statements of losses than can ever come from an exact knowledge of the truth. There is no doubt that there is a tornado evil. Let us learn its exact proportions, and then people will know just what to prepare for.

I do not think that in this table the States of New York and Pennsylvania can be regarded as full-fledged tornado States. Moreover, the comparative loss between fire and tornadoes is not the same as in the other States, owing to the relatively greater loss by fire in the cities in these two States. I have therefore taken out these two States in the final summing-up of the table. Kansas has been left in, however. We find that in the fifteen remaining States the relative loss was one-fourteenth; that is to say, the loss by tornadoes is seven per cent of that by fire. I think we may safely say that any fire insurance company would be entirely secure if they increased their premium by eight per cent or ten per cent, and assured the householder against loss from tornadoes as well as fire, provided such insurance could be placed through all the fifteen States, and for a term of four or five years. As will be shown later, there seems to be good evidence for believing that once in eleven years the risk from tornadoes is somewhat increased for two or three years. When we see that insurance companies, computing from imperfect tornado losses multiplied by 25, have charged the same for both fire and tornado insurance, it is not to be wondered at that so few have taken the latter. Every one has the evidence of his senses that tornado losses in his community in fifteen to twenty years, excepting a few of the more disastrous tornadoes, have not equalled the average fire loss in a single year. It is said that such matters generally adjust themselves through a competition and rivalry between different companies, but it is very unfortunate for a few who have to suffer while this adjustment is taking place. Will it not be far more satisfactory to insured and insurers if this subject be thoroughly ventilated, and a good idea of the comparative risk between fire and tornadoes be arrived at? It should not be forgotten that it is only by uniform action and support of both fire and tornado insurance by the people in the fifteen States, that any thing like an average result can be obtained; or, at least, this must be the case in any one State, for there are a few lines of action in the State which seem to be more favorable for the development of tornadoes than the whole area of the State. H. A. HAZEN.

M. PASTEUR AND HYDROPHOBIA.¹

It is now five years since M. Pasteur introduced to the medical world his alleged cure for hydrophobia. If his much-vaunted discovery possesses all the merits which have been claimed for it, he has earned a fair title to the gratitude of mankind. If, on the other hand, it can be shown that all his theories depend for their acceptance upon a number of very serious fallacies, and that his alleged cures are no cures at all, inasmuch as in those cases the disease never existed, and yet further, that in many cases his treatment has actually induced hydrophobia where it was previously non-existent, M. Pasteur's claim to be regarded, on account of this treatment, as a benefactor of his race, must fall to the ground.

It is now thirteen years since I first wrote a series of articles for the *Medical Press and Circular* on this subject, and they were subsequently published in book form under the title "Rabies and Hydrophobia." On that occasion I pointed out a very serious fallacy underlying many cases of alleged cure of this disease,—the fallacy of regarding persons bitten by healthy dogs as in danger of hydrophobia. At that time I investigated carefully a number of cases of alleged cures by a clergyman residing near Burnley, who had a great reputation in Lancashire for the cure of hydrophobia. The result of my inquiry showed that the Rev. Dr. Verity, the clergyman in question, had had a large number (two thousand) of dog-bitten patients. A few of them had died from hydrophobia after his treatment; but the majority escaped, the reason being that they had been bitten by non-rabid dogs, or had been bitten through clothing, etc. I inquired into numerous other alleged cases of cure of hydrophobia, but always with the same result; and I was thus led to formulate this proposition,—“that if any one obtained a reputation for the prevention of hydrophobia, and if all the dog-bitten sought or took this remedy, the result would be statistically favorable.”

When M. Pasteur startled the world by his first statistics, I was disposed to believe that in the hands of a man of such great scientific fame a cure had been found. I could not, however, avoid noticing the same fallacy running through his statistics which characterized the returns made by the Rev. Dr. Verity. The dog-bitten were certainly rushing to M. Pasteur; but the results were robbed of much of their marvellous character if it could be shown, that, owing to panic and fashion, great numbers bitten by non-rabid dogs were seeking protection.

This objection was supported by another, very powerful consideration. I found, on carefully comparing the statistics given by M. Pasteur with those of the years which preceded the introduction of his system, that the supposed rabid dog-bitten in France had increased in extraordinary proportions; while, at the same time, the average mortality from rabies in France had shown but little fluctuation.

The arguments I have already given are such as will appeal at once to the lay mind. There are, however, certain scientific objections which are still more cogent. The action of the supposed prophylactic, when examined, resolved itself into pure empiricism. A number of injections of rabbits' spinal cords, that had been dried from fourteen to five days, were used, and the old *post hoc* argument was employed: because the children treated by these injections did not subsequently develop hydrophobia, therefore the prophylactic was the remedy. This simple proposition loses its force, however, when we note carefully what really happened. In one series, cords were used based on one formula. Some “cures” resulted, but deaths also occurred. Then the formula was altered, and made more intensive, with the result that a larger number of deaths occurred. A return was then made to the first formula, with some slight modification. Deaths still occurred. In explanation of the deaths, a general affirmation was made that the cases that died came “too late.” But, in looking through the list of patients, I found that the cases which were “cured” were, in many cases, of just as long duration, and that with regard to them no assertion was made that they came “too late.” Take, for instance, the case of Lord Doneraile. If, in his case, eleven days was too late for treatment, then all cases that

¹ Extract from an article by Thomas M. Dolan, M.D., in *The Contemporary Review* for July.

came after that period had elapsed must be expunged from the list of cures. Or, if Lord Doneraile's death was due to the application of the weak or first method, then the cases of the others treated by the same formula fall to the ground.

A yet further objection from the scientific standpoint is to be found in the fact that we know absolutely nothing of the action of these injections. M. Pasteur has not been able to tell us either the rate of absorption of each injection, or any thing of the physiological processes which take place.

In order to substantiate these objections, I shall throughout quote M. Pasteur's own words, and give his own statistics, and the names of his cases. The first point to which I must call attention is the remarkable classification which he has adopted with regard to the proofs that the patients he has treated were bitten by dogs that were really suffering from rabies. The following is the form adopted: Class A. Cases in which the dog was proved to be rabid by the experimental test; Class B. Cases in which the dog was recognized as rabid by the veterinary surgeon; Class C. Cases in which the dog was only suspected of being rabid.

This classification presupposes that all the patients have been exposed to danger. It makes no allowance for non rabid dogs, with the strange result, that, according to these statistics, a veritable epidemic of rabies affecting thousands of dogs must have existed in France during the years which have elapsed since M. Pasteur introduced his system.

It may be objected that in this matter the most eminent medical men in England support M. Pasteur. In reply to this, I will take one of the most eminent of these names, and show that his assertions with regard to the Pasteurian system are not supported by statistical, physiological, or pathological evidence. At a meeting at the Mansion House on Monday, July 1, 1889, Sir James Paget stated, that, "taking the average of all persons bitten by rabid dogs, 15 per cent would suffer from the disease, and 15 per cent would die. . . . In the seven thousand bitten, if fifteen of each hundred had died, there would have been as nearly as possible a thousand deaths, but only a hundred died. Pasteur has therefore saved already nine hundred lives." In the report of the English Hydrophobia Commission, Sir James Paget agrees with his co-workers in stating "that at least 5 per cent of the persons bitten would suffer from the disease." We have therefore two estimates of 5 and 15 per cent as the mortality in the case of those bitten by rabid dogs. With each percentage we obtain a supposed increased saving of life.

In order to realize the value of these assertions as applied to the Pasteurian statistics, let us inquire carefully what was the mortality in France during the years before M. Pasteur took up his work; for it will be manifest that if this system saved nine hundred lives in five years, then there ought to have been an equal or proportionate mortality in France before the introduction of the Pasteurian system. The facts, however, are far otherwise. The illustrious Tardieu, in a report presented to the minister of hygiene in 1863, maintained that twenty-five cases of rabies per year approximately represented the mean mortality in France from that disease.

The following figures represent the mortality in France in each year from 1850 to 1872: 1850, 27; 1851, 12; 1852, 46; 1853, 37; 1854, 21; 1855, 21; 1856, 30; 1857, 13; 1858, 17; 1859, 19; 1860, 14; 1861, 21; 1862, 26; 1863, 49; 1864, 66; 1865, 48; 1866, 64; 1867, 57; 1868, 56; 1869, 36; 1870, 36; 1871, 14; 1872, 15. But these statistics may be objected to on the ground of their antiquity. I therefore give more recent statistics, furnished by one who is not unfavorable to the Pasteur system.

Dr. Dujardin Beaumetz, director of the Sanitary Service of Paris, has addressed to the prefect of police a report on hydrophobia in Paris, furnishing the following data of comparison:—

Four Years antecedent to Pasteur.			Four Years of Treatment.		
Deaths.			Deaths.		
1882	.	9	1886	.	3
1883	.	4	1887	.	9
1884	.	3	1888	.	19
1885	.	22	1889	.	6
		38			37

These figures represent the deaths in the Department of the Seine.

With such figures before us, what becomes of the statement of our distinguished surgeon, that M. Pasteur has by his system saved nine hundred lives, when the national statistics of France prove conclusively that in no five years, for a quarter of a century, preceding M. Pasteur's discovery, did any such number of people die from this disease. The statistics of other countries also negative the statement.

The remarkable effect produced upon the statistics of hydrophobia by M. Pasteur's discovery is yet more strikingly shown when we investigate the returns from the Paris hospitals. On Nov. 2, 1887, M. Pasteur wrote to the Academy of Medicine as follows: "We know that sixty persons have died in the Paris hospitals during the last five years, a mean of twelve per year." After careful investigation of the hospital returns for those years, I am compelled to contradict this statement, and I am prepared to submit to M. Pasteur a full list of the names of all the patients who died in the Paris hospitals during that time, showing the following results: in 1881, 11 died; in 1882, 3; in 1883, 4; in 1884, 3; in 1885, 5. This gives a total of 26, or an average of 5.2 per annum, in place of the annual average of 12, as estimated by M. Pasteur. I am able to give the full details of the number of French patients treated by M. Pasteur who have died since the introduction of the Pasteurian system. For the complete list of the names of the patients, with the date of the bite, date of treatment, and date of death, I am indebted to the energy and ability of Dr. Lutaud. Space will not permit me to give this list in full, but the following is a recapitulation: in 1886, 19 deaths; in 1887, 27 deaths; in 1888, 23 deaths; in 1889, 21 deaths; giving a total of 80, or a yearly average of 20. These cases only represent the deaths after inoculation by M. Pasteur. To obtain the annual mortality of rabies in France, we must add to the foregoing the deaths of those persons who have not been treated at the institute. According to statistics published by M. Pasteur himself in 1886, the deaths among the non-inoculated for that year amounted to 17. If these be added to the 19 who died after treatment, we have an annual mortality of 36, as against an annual mortality, according to Tardieu's returns, prior to the introduction of inoculation, of 25 to 30. With these statistics before us, we are forced to the conclusion that the words quoted from the address of our eminent surgeon at the Mansion House were prompted more by generous impulse, and by feelings of respect and friendship for Pasteur, than by any strict regard to statistical data. As we have seen, Sir James Paget fixes the general mortality of those bitten at 15 per cent. M. Pasteur, in his article in the *New Review* (December, 1889) accepts this estimate, but thinks it is too low for bites on the face and other exposed parts. In such cases he thinks that the figures should be from 60 to 90 per cent. If we add up the number who have been bitten on exposed parts, and accept these percentages, then M. Pasteur's saving of life has been much greater, and his cures for France alone amount to some hundreds per annum. When we remember the ascertained mortality in France, and the rarity of hydrophobia there in past years, such percentages as the foregoing reduce the system to an absurdity.

The good old Dr. Berkenhout, writing about rabies in 1783, told us that he knew not of any human attempt which had a better resemblance to the Knight of La Mancha's attack on a windmill than that of combating popular errors and reasoning against popularly received opinions. I have been at times disposed to accept this view, and have felt inclined to let popular fashion expend itself. When I first criticised the method of Pasteur, what I said was received with incredulity and positive disfavor; but as time went on, and many of my predictions were verified, the incredulity gave place to greater tolerance in regard to opinions expressed against the system. There was a complete change of front. The infallibility of the method was abandoned, and its apologists adopted another tone. "Pasteur's system was not perfect," they said. "No system of therapeutics was perfect. Pasteur would be an angel, and not a man, if he could, at one coup, bring rabies into subjection." "Give him time," said another. Yet another apologist appealed to the law of averages, and said, "Pasteur has reduced the mortality from 5 per cent to 1 per cent."

To M. Peter the world owes the first exposure of the dangers of

the intensive method. It required great courage on the part of Dr. Peter, Dr. Lutaud, and others in France, and Dr. B. W. Richardson in England, to oppose the fashion. Had they not been actuated by a pure love of science, they would have been silenced. It is, however, not unsafe to prophesy that the intolerance of the new school in France, as shown in its treatment of Professor Peter, will bring about its own downfall.

Have we any treatment, then, that is satisfactory, based on these discoveries? The only answer to this question must be an emphatic "No!" The clinical observer has been very patient, knowing that he could afford to wait. Professor Peter, one of the greatest of contemporary clinical observers, and the worthy successor of Trousseau, has endeavored to save medicine from the reign of terror formed by the coterie which, in the name of science, anathematized all who ventured to doubt their theories. "You are unscientific," said the coterie; "you do not believe in our methods of modern research, and you cannot have a hearing." This kind of language has silenced many, because, when there is a fashion, men foolishly imagine that they will be looked on as progressive if they go with the tide. Martyrdom is not so eagerly sought after; and social ostracism is the penalty, too often, for appearing in a minority, as did M. Peter at the Academy. Clinical observers may, however, take heart: there are signs that the cloud will lift, and that medicine will yet be emancipated from the trammels of what has been so well called "vaccinomania."

BOOK-REVIEWS.

Advanced Physiography. By JOHN THORNTON. London and New York, Longmans, Green, & Co. 12°. \$1.40.

THIS book treats of advanced physiography as defined by the syllabus of the Science and Art Department of South Kensington, London. It embraces a concise statement of astronomy; an account of the size, shape, and density of the earth; a brief consideration of atmospheric and oceanic movements and of terrestrial magnetism; and some mention of certain other things on which questions might be asked in the science and arts examinations. Several sample examination-papers are appended, so that the student may, as it were, see what he is studying for. The examinations certainly are of value, and tend to turn school studies in directions approved of by competent educators; but, when it comes to writing a book to meet the examinations, the lover of pedagogics may well rebel. Mr. Thornton has done his task conscientiously. He has searched through good works for his materials, and has said something of every thing that the most ingenious examiner could ask about, and said it concisely and well, as a rule. He has avoided the staleness of old text-books, and has introduced many results of recent investigations; but, for all this, his book still leaves the impression of leading its students to South Kensington, rather than to good mental training. Moreover, the frequent wholesale quotation from other text-books gives the impression that the author is too greatly a compiler, and too little an investigator. In these modern days, when the preparation of school-books is considered worthy work for the director of the Geological Survey of Great Britain, for the superintendent of our Nautical Almanac Office, and for other eminent scholars, it makes us a little impatient to meet a book that is so distinctly a compilation as this one is; but perhaps we lay too great emphasis on this point. Books on physiography, as here defined, must be in great part compilations.

If not an investigator, the author is evidently a practised teacher; and his chapters, paragraph headings, and illustrations show an aptitude in methods of statement and explanation that must bear good result. The careful account of the different methods of finding the masses of the planets, the full description of modern spectroscopy, and the extended chapter on comets and meteors, may be cited in evidence of this. The accounts of the tides and of the winds are distinctly less successful. Occasional lapses appear, such as, "Heat and light are forms of radiant energy," or as latitude being shown as an angle at the centre of the earth, or as making our tornadoes identical with West Indian hurricanes and Chinese typhoons; but errors of even this minute

kind are not common. Condensation of statement in certain chapters will either leave much work for the teacher, which is not objectionable if he is equal to it, or will leave the scholar in a very confused state of mind; and this leads back to our starting-point, that a book prepared to enable students to meet examinations is not the best kind of a book for securing intellectual training.

Graphical Statics. By LUIGI CREMONA. Tr. by Thomas H. Beare. Oxford, Clarendon Pr. 8°. (New York, Macmillan, \$2.25.)

THOSE who are accustomed to make use of mathematics as a tool, and who are not able to ascend into the higher regions of pure mathematics farther than is necessary to secure their practical ends, especially the engineer seeking the solution of the problems in kinematics and in mechanics that come to him in the course of his regular professional work, often have occasion to remark upon the extremely limited range of problems which are capable of solution by algebraic processes, and upon the greater effectiveness of the geometric methods. A glance at any treatise, on any branch of engineering, will show how narrow is the field of application of the algebraic systems to the practical work of the constructor. Where the elements are few, the conditions very simple, and the results sought similarly easy of expression, algebraic methods come in play; but, as in astronomy, the introduction of a little wider generalization, of a single new condition, often carries the problem entirely outside the field of application for the algebraist. Algebra does marvellous work, but its limits are soon reached. Graphical methods are often found to be far more satisfactory, not only in their ease of application, but in the readiness with which the results may be comprehended and translated into the language, and represented by the work of every-day practice. Thus it happens that "graphical statics" has come forward, within a very short time, as the most valuable tool of the engineer.

The father of the system, in some sense, is the well-known Culmann, whose treatises have been translated into English by Du-bois; but some work had been done even before he attempted collating and systematizing it. Rankine did much in this field; and many minor writers have added, each his mite, to the subject. We observe that Cousinery is credited with many contributions to the subject by the writer of this latest treatise. Professor Cremona begins by the presentation of the system of signs adopted, in which he follows Moebius, and then takes up the work in the usual way, giving the standard methods of arithmetical treatment, the graphics of the four rules; the discussion of the processes of graphical involution and evolution; the solution of numerical equations; and the discussion of the centroids. The second part consists of a discussion of reciprocal figures, including Rankine's theory of structures and polygonal frames, and Culmann's work in the same department. The work is well written, the system satisfactory, and the methods in detail logical and exact. Professor Beare is entitled to commendation for his admirable translation; and both he and its author deserve much from the English-speaking reader and student of "Graphical Statics."

Like all the work of the Clarendon Press, the book-making is excellent, and deserving of all praise.

Cycling Art, Energy and Locomotion. By ROBERT P. SCOTT. Philadelphia, Lippincott. 12°.

THIS is an interesting little 12mo treatise on the art of the wheelman, which, in a space of three hundred pages, gives a good historical summary, and an account of the later forms of the wheel, and of the principles of their construction and operation, and presents the mathematical and scientific principles of their balancing and propulsion. One of the most interesting chapters in the book is that in which the author gives the graphical measurements obtained by him with an autographic apparatus devised by himself to record the resistances to the motion of the machine and the pressures of the foot on the pedal. Exact knowledge on these points has not heretofore been obtainable, and this investigation is a real contribution to our knowledge in this field. The

"cyclograph" will undoubtedly do much service hereafter. An analysis of the motions of the machine as it passes over obstructions is also likely to prove of value in the promotion of safety, and in the elimination of the "header" from the list of casualties.

A chapter on ball-bearings includes a discussion of the subject by Professor S. W. Robinson, which is a valuable contribution, especially as giving the limit of weight allowable for balls of any given size. The co-efficient of friction for a one-inch ball is given as about 0.00175, as derived from experiments upon the Lick telescope. The book is full of interesting information for the wheelman, and abounds in good reading for all those who are interested in the subject.

Steam. By WILLIAM RIPPER. London and New York, Longmans, Green, & Co. 12s.

THIS is a little primer of steam and the steam-engine. It is a reproduction of notes of lectures addressed by its author to an evening class of young "mechanical engineers" (the term is evidently not applied to the class usually considered to be represented by it in this country), and includes a course of discussions of steam-engines, boilers, and accessory subjects.

Within these two hundred pages are compressed the best compendium of the subject that has yet been published. It is also, so far as we have been able to discover, accurate, and is evidently written by an engineer familiar with the science and the art, and not, as is too often the case where these primers are produced, by an amateur or tyro hardly more familiar with the subject than those to whom his instruction is offered. A preliminary discussion of the physical properties of steam, the chemical principles of combustion, and the elements of thermodynamics, is followed by a brief description of the modern steam-engine, its construction, and its performance, which is really of value, and might well repay the professional for the time required to read it. The book is well illustrated, in the sense of having a good list of engravings, though their quality as specimens of the engraver's art may not be reckoned high, in the opinion of the expert. The compound

engine is described, and its principles summarized, and the book is concluded by a chapter on the management of engines and boilers.

AMONG THE PUBLISHERS.

WE have received No. 30 of "Odds and Ends from the Literary Junk Shop," by A. S. Clark of 34 Park Row, this city.

—"Education as a Factor in Civilization" is the title of an essay by Caroline B. LeRow in the *Modern Science Essayist* for June 15. In the issue of July 1 John W. Chadwick treats of "Evolution and Social Reform," dealing mainly with "The Theological Method."

—Painters—and by this we mean artists, and not carriage or house painters—are not, as a class, persons likely to take interest in the chemistry of paints and painting. Yet it appears that the Royal Academy of Arts in London has a professor of chemistry in the person of A. M. Church, a master of arts, and fellow of the Royal Society; and this same Professor Church has written a "Chemistry of Paints and Painting," which is published in New York by Macmillan. The book is intended for those who use paints, and is meant as a help, that paints and varnishes may be well chosen and properly used. It is not expected that any one will read the book through, but that information will be sought within its covers as occasion may occur. It has therefore happened that to some extent the same matter has been inserted under more than one heading in the book. The book is unique in its field, and should be available to all likely to be interested.

—Mr. Arthur H. Noll has written "A Short History of Mexico," which has been published by A. C. McClurg & Co. of Chicago. The author states in his preface that he has been unable to find any comprehensive history of Mexico in the English language, and he has accordingly endeavored to make up the deficiency. We wish we could say that he has succeeded; but in fact his work is extremely unsatisfactory. He has no intelligent concep-

Macmillan & Co.'s New Books.

Now Ready. Vol. III. completing the work.

A HANDBOOK OF DESCRIPTIVE AND PRACTICAL ASTRONOMY.

By G. F. CHAMBERS, F.R.A.S.

Vol. I. THE SUN, PLANETS AND COMETS.
8vo, \$5.25.

Vol. II. INSTRUMENTS AND PRACTICAL ASTRONOMY.
8vo, \$5.25.

Vol. III. THE STARRY HEAVENS.
8vo, \$3.50.

"A valuable mine of astronomical information carefully brought up to date."—*Academy*.

THE ADVANCEMENT OF SCIENCE.

Occasional Essays and Addresses

By E. RAY LANKESTER, M.A., LL.D., F.R.S. 8vo, \$3.00.

SCIENTIFIC LECTURES

By Sir JOHN LUBBOCK, F.R.S., D.C.L., LL.D. Second Edition. Revised and Enlarged. 8vo, \$2.50.

FIFTY YEARS OF SCIENCE;

Being the Address delivered at York to the British Association by Sir JOHN LUBBOCK, F.R.S., D.C.L., LL.D.
New Edition. 12mo. 75 cents.

MACMILLAN & CO., 112 4th Avenue, N. Y.

APPLETONS' GUIDE BOOKS.

APPLETONS' GENERAL GUIDE TO THE UNITED STATES AND CANADA.

With numerous Maps and Illustrations. New edition, revised for the present season.

In three separate forms: one volume complete, 12mo, morocco tuck, flexible, \$2.50; one volume New England and Middle States and Canada, cloth, \$1.25; one volume Southern and Western States, cloth, \$1.25.

APPLETONS' HAND-BOOK OF SUMMER RESORTS.

Fully revised for the Season of 1890. With Maps and numerous Illustrations. Large 12mo, paper cover. Price, 50 cents.

APPLETONS' DICTIONARY OF NEW YORK AND ITS VICINITY.

An Alphabetically arranged Index to all Places, Societies, Institutions, Amusements, and other features of the Metropolis and Neighborhood upon which Information is needed by the Stranger or the Citizen. New edition, revised and corrected to the present time, just ready. With Maps of New York and Vicinity. Paper cover, price, 30 cents.

D. APPLETON & CO., Publishers,
1, 3 & 5 BOND STREET, NEW YORK.

BOOKS: How to Exchange them for others. Send a postal to the SCIENCE exchange column (insertion free), stating briefly what you want to exchange. SCIENCE, 47 Lafayette Place, New York.

PRACTICAL ELECTRICAL NOTES AND DEFINITIONS.

For the use of engineering students and practical men by W. P. MAXCOK, together with Rules and Regulations to be observed in Electrical Installation Work, with diagrams. 180 pages, 32mo, cloth, 60 cts. E. & F. N. SPON, 12 Cortlandt St., New York.

HEAVEN AND HELL. 416 p., paper. DIVINE LOVE AND WISDOM. 383 p., paper. By EMANUEL SWEDENBORG. Mailed, prepaid, for 14 cents each (or 25 cents for both), by the American Swedenborg P. and P. Society, 20 Cooper Union, N. Y. City.

BOOKS 50,000 vols. of ancient and modern rare and scarce books offered for sale. Send for books tried to obtain elsewhere without success. American, British, German and French Books. Catalogues mailed free to Bookbuyers.

C. N. CASPAR, Book Emporium 437 E. W. St., Milwaukee

JUST PUBLISHED.

POPULAR MANUAL OF VISIBLE SPEECH AND VOCAL PHYSIOLOGY.

For use in Colleges and Normal Schools. Price 50 cents. Sent free by post by

N. D. C. HODGES, 47 Lafayette Place, New York

Old and Rare Books.

Back numbers Atlantic, Century, Harper, and Scribner, 10 cents per copy, other magazines equally low. Send for a catalogue.

A. S. CLARK,
Bookseller,

34 Park Row, New York City.

BACK NUMBERS and complete sets of leading Magazines. Rates low. AM. MAG. EXCHANGE, Schoharie, N. Y.

tion of what history is, his narrative being little more than a brief account of the various viceroys, generals, presidents, and other administrators, that Mexico has at different times had. He gives no information of any value about the condition of the people at any period; he tells us little or nothing about the civilization of the Aztecs, though he relates a good deal of their legendary history; he fails to describe the mode in which the Spaniards governed the country, and he leaves us completely in the dark as to the history of legislation and the moral and material development of the Mexican nation. A good history of Mexico is still a desideratum.

—An important work by Dr. Daniel G. Brinton will be published in a few weeks by N. D. C. Hodges, 47 Lafayette Place, New York. The book, which will be entitled "Races and Peoples," will be a review of the whole domain of ethnography, with particular attention to the white or European race, the Aryan peoples, their origin and distribution. The latest opinions of the leading European scholars have been consulted, but the work is largely the result of independent research, and does not follow any especial school of ethnographers.

—G. P. Putnam's Sons have in press for early publication "The Trees of Northeastern America," by Charles S. Newhall, with an introductory note by Professor N. L. Britton of Columbia College, which describes all the native trees of the northern United States east of the Mississippi, as well as mentions the more important naturalized species, with illustrations made from tracings of the leaves of the various trees; "Gustavus Adolphus and the Struggle of Protestantism for Existence," by C. R. L. Fletcher, in the Heroes of the Nations Series; "The Jews under the Romans," by the Rev. M. Douglas Morrison, in the Story of the Nations Series; "Dust and its Dangers," by Dr. T. M. Prudden, written with the purpose of informing people, in simple language,

what the real danger is of acquiring serious disease, especially consumption, by means of dust-laden air, and how this danger may be avoided; "Among Moths and Butterflies," by Julia P. Ballard, a well-written book, on an interesting subject, for young people; and a new and popular edition of "Seven Thousand Words often Mispronounced," which has proved one of the most successful of Phyfe's books. They have also under way "Tabular Views of Universal History."

—The *Nation*, with its issue of July 3, enters on its twenty-sixth year of publication. It was started with the intention of supplying the educated public of America with political and literary criticism of a somewhat higher order than that previously in vogue. We had had, indeed, much good literary criticism in some of our magazines, but political discussion in the newspapers had not been so thoughtful or so independent as it should have been. The *Nation* took a perfectly independent stand from the first, and has maintained it ever since. Its articles, too, especially on political and economical affairs, have been distinguished by greater depth of thought than those of most American papers, and, though its superiority in this respect is not relatively so great at the present time, it still maintains a high rank. It has honorably distinguished itself by its advocacy of political honesty and sincerity, and by its support of certain special reforms, those of the tariff and the civil service being the most prominent. Its chief fault is a certain cynical tone and inclination to fault-finding, when something different would be at once more agreeable and more effective. Denunciation of wrong-doers is sometimes necessary; but it has no such efficacy as those who indulge in it are apt to suppose. Since its consolidation with the *Evening Post*, the character of the *Nation* has been to some extent changed; yet it continues under the same management as before, and its fundamental characteristics are still preserved. We wish it a continued career of prosperity and usefulness.

CATARRH.

Catarrhal Deafness—Hay Fever.

A NEW HOME TREATMENT.

Sufferers are not generally aware that these diseases are contagious, or that they are due to the presence of living parasites in the lining membrane of the nose and eustachian tubes. Microscopic research, however, has proved this to be a fact, and the result of this discovery is that a simple remedy has been formulated whereby catarrh, catarrhal deafness and hay fever are permanently cured in from one to three simple applications made at home by the patient once in two weeks.

N.B.—This treatment is not a snuff or an ointment; both have been discarded by reputable physicians as injurious. A pamphlet explaining this new treatment is sent free on receipt of stamp to pay postage, by A. H. Dixon & Son, 337 and 339 West King Street, Toronto, Canada.—*Christian Advocate*.

Sufferers from Catarrhal troubles should carefully read the above.

ANY OF

Prof. A. MELVILLE BELL'S WORKS

—ON—

Elocution — Visible Speech — Principles of Speech—Faults of Speech—Phonetics—Line Writing — World - English, etc.,

SUPPLIED BY

N. D. C. HODGES,

47 Lafayette Place, N. Y.

Do You Love your Wife and Children

enough to take the trouble to send for our Illustrated Pamphlet, which will tell you how to keep them well?



All impure and offensive odors absolutely removed.

SHERMAN "KING" VAPORIZER COMPANY,
Chicopee Falls, Mass.; Boston, New York,
Philadelphia, or Chicago.

Readers of Science

Corresponding or visiting with Advertisers, will confer a great favor by mentioning this paper.

A New Method of Treating Disease.

HOSPITAL REMEDIES.

What are they? There is a new departure in the treatment of disease. It consists in the collection of the specifics used by noted specialists of Europe and America, and bringing them within the reach of all. For instance, the treatment pursued by special physicians who treat indigestion, stomach and liver troubles only, was obtained and prepared. The treatment of other physicians celebrated for curing catarrh was procured, and so on till these incomparable cures now include disease of the lungs, kidneys, female weakness, rheumatism and nervous debility.

This new method of "one remedy for one disease" must appeal to the common sense of all sufferers, many of whom have experienced the ill effects, and thoroughly realize the absurdity of the claims of Patent Medicines which are guaranteed to cure every ill out of a single bottle, and the use of which, as statistics prove, *has ruined more stomachs than alcohol*. A circular describing these new remedies is sent free on receipt of stamp to pay postage by Hospital Remedy Company, Toronto, Canada, sole proprietors.

A TEMPORARY BINDER

for *Science* is now ready, and will be mailed postpaid on receipt of 75 cents.



This binder is strong, durable and elegant, has gilt side-title, and allows the opening of the pages perfectly flat. Any number can be taken out or replaced without disturbing the others, and the papers are not mutilated for subsequent permanent binding. Filed in this binder, *Science* is always convenient for reference.

N. D. C. HODGES,

47 Lafayette Place, N. Y.



DO YOU INTEND TO BUILD?

We offer an Atlas of Sensible Low Cost Houses, a portfolio 11x14 inches, containing handsome illustrations, floor plans, and full descriptions of this popular design, and fifty-four others, ranging in cost from \$800 to \$7,200. This specimen design is for a cottage with seven rooms, and costing \$1,100. It combines beauty and comfort, has two large porches, and is a popular and practical working design, having been built several times for its estimated cost.

No matter what style of a house you may intend to build, it will pay you to have this book.

We will send this Atlas, postpaid, on receipt of price, \$1.—N. D. C. Hodges, 47 Lafayette Place, New York.

BOOKS: How to get them. If there is any book or pamphlet that you want, write to the Science Book Agency, 47 Lafayette Place, New York.

OF WHAT USE IS THAT PLANT?

You can find the answer in

SMITH'S "DICTIONARY OF ECONOMIC PLANTS."

Sent postpaid on receipt of \$2.80. Publisher's price, \$3.50.

SCIENCE BOOK AGENCY,

47 Lafayette Place, New York.

CHEMICAL BOOKS FOR SALE.

ANALYST, London (1887-89, July and November of 1888 missing)	1.80
SUGAR CANE, Manchester (1881-83, 1885-86, also numbers of 1884, 1887, and 1888)	2.40
ZEITSCHRIFT Rubenzuckerindustrie Stammer (1885-86, part of 1887)	1.20
ZEITSCHRIFT Rubenzuckerindustrie Schublers (Vols. xiv.-xvii. inclusive), complete	2.40

Any of the above will be sent postpaid on receipt of price.

SCIENCE BOOK AGENCY,

47 Lafayette Place, New York.

RUPTURE

cured in stipulated time.

NO DELAY FROM WORK. NO OPERATION.

Call or send stamp for circular and reference of those cured. We have on hand over 300 styles of trusses, from \$1 up, and suspensories of all kinds. Orders filled by mail or express to any part of the United States.

C. A. M. BURNHAM, M.D.,
138 Clinton Place, New York.

N. D. C. HODGES, 47 Lafayette Pl., New York,
Announces as Just Published

Fact and Theory Papers

THE SUPPRESSION OF CONSUMPTION.

By GODFREY W. HAMBLETON, M.D. 12°. 40c.

"The inestimable importance of the subject, the eminence of the author and the novelty of his work all combine to render the little treatise worthy of special consideration. . . . We heartily commend Dr. Hambleton's booklet and wish there were more such works."—Editorial, *Boston Daily Advertiser*.

"The monograph is interesting in style, scholarly, and well worth of careful consideration. It is devoid of technical expressions, and can be easily read and digested."—*Pharmaceutical Era*.

"It is full of facts and wisdom."—*Philadelphia Saturday Evening Post*.

"The book contains much of importance to the medical fraternity, as well as the general populace."—*Burlington Hawkeye*.

"We commend the book to physicians and laymen."—*Herold* (German), Milwaukee.

THE SOCIETY AND THE "FAD."

By APPLETON MORGAN, Esq. 12°. 20 cents.

"Mr. Morgan founds a sensible and interesting address upon a text furnished by a sentence from a young ladies' magazine; namely, 'Browning and Ibsen are the only really dramatic authors of their century.'"—*New York Sun*.

"In the little book before us the treatment of the subject is dispassionate and logical. The comparison drawn throughout this monograph is between Shakespeare and Browning, the subject-matter being largely based on the Browning and Shakspearian societies and how they came to exist. A pleasant half-hour or more may be spent over the book, and some useful information derived from it."—*Englewood Times*.

PROTOPLASM AND LIFE.

By C. F. Cox. 12°. 75 cents.

The author of this book was for some years president of the New York Microscopical Society, and in this volume he sets forth his views on the spontaneous generation theory and its relation to the general theory of evolution, and on protoplasm and the cell doctrine.

Ready at an early date.

THE CHEROKEES IN PRE-COLUMBIAN TIMES

By CYRUS THOMAS. 12°. \$1.

Dr. Thomas in this work will reverse the usual method of dealing with prehistoric subjects; that is to say, he will commence with the earliest recorded history of the tribe as a basis and trace the chain back step by step by the light of the mounds, traditions, and other evidence, as far as possible. He has already presented to the public some reasons for believing the Cherokees were mound-builders, but additional evidence bearing on the subject has been obtained. A more careful study of the Delaware tradition respecting the Tallegwi satisfies him that we have in the Bark Record (Walam Olum) itself proof that they were Cherokees. He thinks the mounds enable us to trace back their line of migration even beyond their residence in Ohio to the western bank of the Mississippi. The object is therefore threefold: 1. An illustration of the reverse method of dealing with prehistoric subjects; 2. Incidental proof that some of the Indians were mound-builders; 3. A study of a single tribe in the light of the mound testimony. This work will be an important contribution to the literature of the Columbian discovery which will doubtless appear during the coming two years.

THE TORNADO.

By H. A. HAZEN. 12°. \$1.

Professor Hazen is one of the prominent meteorologists connected with the United States Signal Office. In this work he reviews our present information as to tornadoes, severely criticising some of the opinions held in regard to them up to this time. No one has given a more careful study to these destructive storms than has Professor Hazen, and his book will prove a decided contribution to the world's knowledge. In this book will be found a careful discussion of the important question of Tornado Insurance now attracting so much attention. Hundreds of dollars may be saved by people who are thinking of such insurance by following the principles here made plain.

In Preparation.

Foods and Food Adulterants.

By EDGAR RICHARDS, Ex-president National Chemical Society.

Color in Nature.

By G. BROWN GOODE and others.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.

AN EXPERIENCED TEACHER desires to hear of a town in which he can establish a high school. Or, he will lease an academy. Address, G., Lock Box 18, Suffern, N. Y.

WANTED.—By a lady-graduate of Cornell University, position as teacher in high school, seminary or college; prepared to teach the following branches, employing, so far as is practicable, the laboratory method: Geology, Botany, Zoology, Physiology; also, if desired, Physics, Chemistry, Logic and Psychology. References to heads of above-named departments in Cornell University. JENNIE T. MARTIN, care Cornell University, Ithaca, N. Y.

A GENTLEMAN of experience, highly recommended, liberally educated at home and abroad, desires to correspond with parties needing an instructor in the classics or modern languages in a high grade institution. Address EARLHAM, Germantown, Pa.

WANTED.—At the Bryant Summer School, Roslyn, L. I., a Lady to teach Sea-Life, and other Sciences. July 8-Sep. 8. Ten weeks to six months according to her convenience. Other papers please copy. E. HINDS, A. M., Principal.

WANTED.—Information concerning the production of Mushrooms in caves and other places. Address M. H. CRUMP, care Ky. Geological Survey, Frankfort, Ky.

A YOUNG MAN, graduate from an American College, who has studied a year in Germany, and is now studying in Paris, would like professorship in chemistry. References from some of the best chemists. Address CHARLES E. LINEBARGER, Post-Restante, Paris, France.

WANTED.—An opportunity to study qualitative analysis in or near New York City during the summer. W. J. L., 130 Spring st., Sing Sing, N. Y.

ASSAYER.—Wanted position as above, has had three years' practical experience in a London firm of assayers to the Bank of England, Royal Mint, etc., etc. Thorough knowledge of bullion assaying, and of gold, silver, and lead ores. I. FRED. JOHN-SON, Northgate Brewery, Canterbury England.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

For exchange—14 volumes (1883-1889) American Journal of Science, 10 volumes (1880-1889) American Naturalist, 21 volumes (1879-1890) English Mechanic, all in good condition for binding; also, Morris Typewriter. Wants first-class microscope, camera, chemical or physical apparatus. Address, with full particulars, E. R. Chadbourn, Lewiston, Maine.

Wanted.—To exchange land and fresh-water mollusca, (principally *Helices Achatinellae*, Clausiliae and Limnaeae), for those not in my collection. Lists exchanged. Address E. H. White, Box 200, Astoria, Or.

Meteorites.—Mr. George F. Kunz, 11 to 15 Union Square, New York, or Hoboken, N. J., will buy or give in exchange for whole or parts of meteorites. Whole ones, undescribed ones, and entire falls especially desired.

Wanted.—To furnish roots of *Dodecatheon Meadia*, *Sarracenia purpurea*, and other wild flowers, native of Southern Wisconsin, in quantities. D. E. Willard, Curator of Museum, Albion Academy, Albion, Wis.

I have a number of duplicates of microscopic slides, mostly botanical, which I would like to exchange for others not now in my collection. Send list of what you have to exchange and get my list. S. R. Thompson, New Wilmington, Pa.

THIRD EDITION.

THE FAULTS OF SPEECH

BY

A. MELVILLE BELL,

Author of "Visible Speech," etc., etc.

The Faults of Speech is a Self-Corrector and Teacher's Manual, for the removal of all Impediments and Defects of Articulation.

60 Cents.

* * Sent postpaid on receipt of price,

N. D. C. HODGES, 47 Lafayette Place,
NEW YORK.